

Enhanced Wildland Fire Management Decision Support Using Lidar-Infused LANDFIRE Data

The United States has experienced increases in severe wildfire behavior, property losses, and costs. Concurrently, recognition of the role of fire in restoring and maintaining resilient ecosystems has increased. These factors intertwine to create difficult decision-making for land managers and society at large, in which some fires are extinguished while others are allowed to burn. As society begins to learn how to live with fire, land managers are attempting to develop consistent strategies and tactics to safely and efficiently manage fire for benefit while protecting people and communities from harm. New decision support tools are continuously being developed to support this endeavor.

The Wildland Fire Decision Support System (WFDSS) is the de-facto decision support tool for federal fire managers. WFDSS integrates fire behavior prediction models and economic tools to assess wildfire-threatened values, such as houses or infrastructure. The resulting risk and vulnerability assessments provide a consistent and quantitative framework for decision-makers.

Vegetation structure and fuels products from the Landscape Fire and Resource Management Planning Tools Program (LANDFIRE) provide data that inform decision support tools such as WFDSS. LANDFIRE provides nationally continuous data using consistent methodologies which are used to support national and regional strategic planning. However, these data are often inadequate for developing local strategies and tactics, placing considerable demand on local units to develop local data. In particular, information related to the 3D arrangement of material within vegetation canopies is not well represented in the LANDFIRE maps. This is, in part, driven by LANDFIRE's reliance on Landsat imagery as the sole remote sensing data input for mapping; such imagery does not directly capture the vertical distribution of canopy elements.

Detailed vegetation structure information derived from lidar, as compared to Landsat imagery (Figure 1), can be integrated with the LANDFIRE product suite to generate locally enhanced vegetation structure and fuels maps. Among remote sensing data, lidar is uniquely suited for estimating canopy structure and fuels characteristics. However, lidar-derived fuel data are still relatively scarce, which can be attributed in part to two underlying issues. First, the LANDFIRE program has become the default source of large scale fire behavior modeling

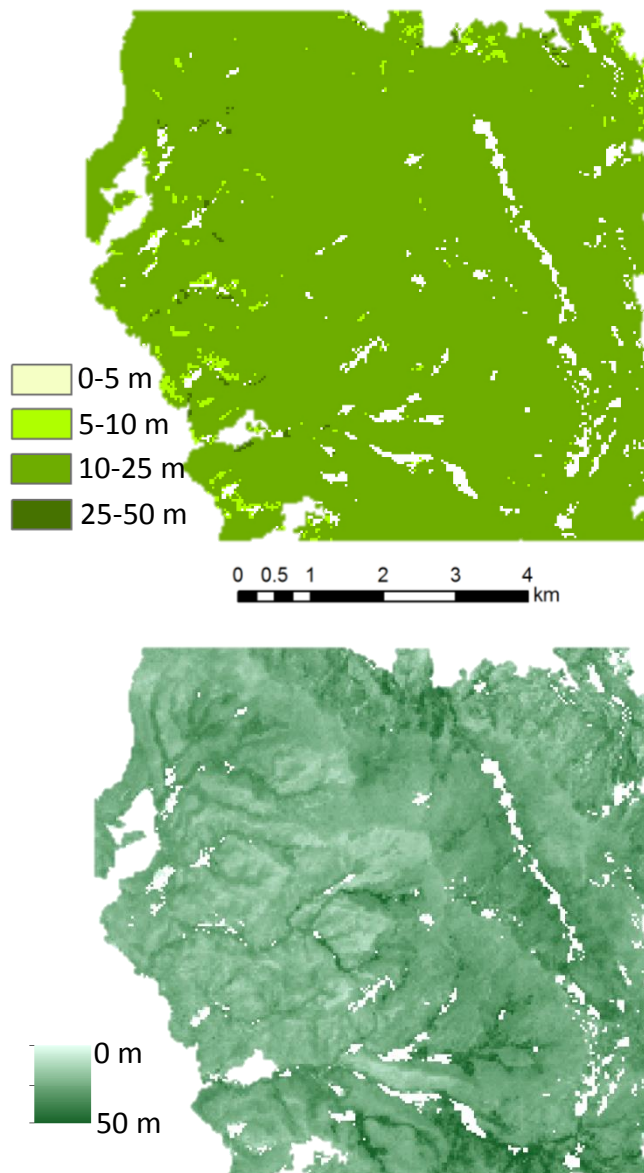


Figure 1. Canopy height products from Landsat-based LANDFIRE (top) and lidar-derived CHISLIC. Because of the source of the input data for the LANDFIRE canopy height product the legend needs to be binned. The CHISLIC canopy height product, mapping a continuous variable, better represents the heterogeneity of canopy height across this landscape in Grand County, CO.

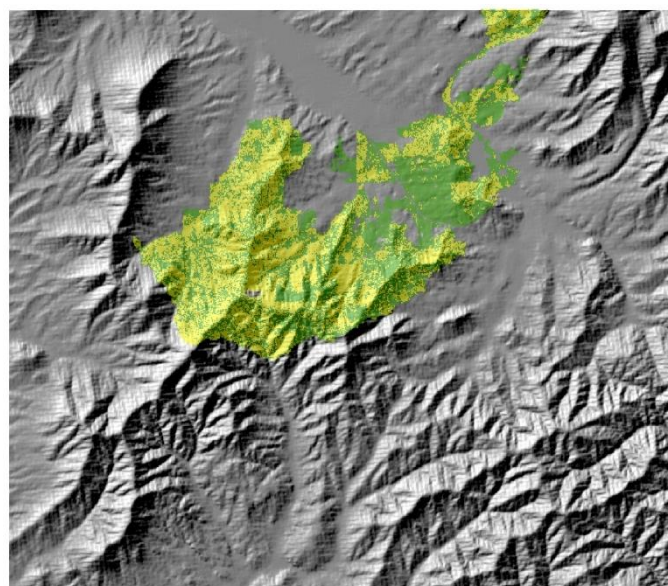
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inputs because it provides consistent, nationwide data regarding the distribution of vegetation structure and canopy fuel across the landscape. However, LANDFIRE does not currently incorporate lidar data into the vegetation and fuel mapping process because they are not consistently available nationwide. Second, while lidar data are available for many land management units across the United States, these data are underutilized for fire behavior applications. This is partly due to a lack of local personnel trained to process and analyze lidar data. This project is addressing both of these issues by developing the Creating Hybrid Structure from LANDFIRE/lidar Combinations (CHISLIC) tool.

Many wildland fire analysts and managers, who regularly use LANDFIRE data and who would benefit most from lidar data use, fail to do so because of a lack of familiarity with these data and the tools available to process them. CHISLIC has been created to enable the easy integration of lidar data into LANDFIRE canopy height, canopy cover, and canopy base height products. This accomplishment significantly advances the likelihood of available lidar data being applied in fire behavior analyses and related research and management concerns. The potential impact of integrating lidar-derived structure with LANDFIRE products can be seen in Figure 2.

Continued development of CHISLIC will foster the integration of lidar data with LANDFIRE, thereby leading to the generation of products derived from the best data available. Furthermore, no lidar data are currently used operationally to support wildland fire management decisions. CHISLIC is the first tool of its kind that is specifically designed to leverage airborne and spaceborne lidar data to improve the canopy fuel maps that are critical to support wildland fire management decisions. Future plans for CHISLIC include the development of additional functionalities to broaden CHISLIC's utility and improvements to make CHISLIC more robust. CHISLIC will also be ported to a web server-based platform to make it more accessible to a larger group of users. Continued support will also allow the establishment of a permanent operational base for CHISLIC at WFDSS that will foster development and support into the future.

The USGS and the USFS are working together to further develop the utility of CHISLIC and to transition it to an operational application hosted at WFDSS. Over the next three years CHISLIC will become a go-to tool for those in the fire community to use and integrate lidar into LANDFIRE data.



Fire Type
Surface
Torching
Crowning

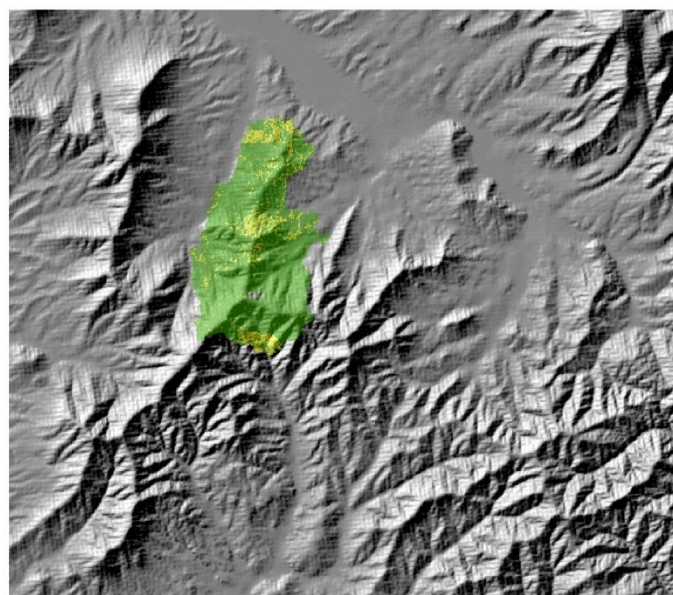


Figure 2. Example of impacts in using LANDFIRE (top) products vs. CHISLIC (bottom) products on modeled fire type using data from an area near Coeur d'Alene, ID.

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